Industrial Finishing

For Users of Fillers, Shellacs, Varnishes, Etc.

NOVEMBER, 1924

IN THIS ISSUE—

FINISHING FURNITURE IN FRENCH WALNUT

PAINTING RAILWAY CARS WITH AIR BRUSH

BAKED ENAMEL PROCESS FOR AUTO FINISHING

AND OTHER ARTICLES OF INTEREST FOR THE INDUSTRIAL FINISHER

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INDUSTRIAL FINISHING is the answer to this demand. In its pages the publishers will strive to include only what practical men desire in the way of a live finishing journal. Pages will not be padded with space writing, lengthy reports or matters about which finishers and factory executives have little if any interest. INDUSTRIAL FINISHING respects the value of its readers' time and energy, and will endeavor to limit reading matter to worth-while subjects presented in a clear and thorough manner.

You are urgently invited to write to INDUSTRIAL FINISHING and tell us what you desire to see in these pages. We recognize the following basic truth in journalism, namely, that what the majority of readers desire, in the way of reading matter, must be the guiding editorial policy of a successful publication. Practical articles and illustrations, therefore, will be supplemented by notes and news of the trade, featuring particularly what is new in the way of finishes, finishing apparatus and finishing processes.

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The Spray System of Finishing

Applying liquid finishes in the form of a fine spray, with a compressed-air gun, insures an even rapid coating with no fatty edges, no bare corners, no streaks and no runs. This system is now in successful use in many different industries

By T. F. Metsger

FOR several years the spray-painting system of applying varnishes, enamels, lacquers and like materials has been a potent factor in increasing production, improving results and reducing costs in the industrial finishing room. The practicability of the method and the dependability of the equipment have been fully demonstrated in a large and exacting field.

The spray-painting system is comprised of the following units:

1. Spraying equipment embracing the spray gun in separate container or attached-cup type, air regulating and cleaning device, electric air and material heater, air and fluid hose, air duster, pressure-feed or overhead gravity-feed material container.

2. Air compressing plant consisting of air compressor, motive power and air receiver.

3. Exhausting equipment which includes fireproof steel booth (in which spraying is done) with electric exhaust fans installed in the back.

4. Handling devices or turntables, hand or air-operated or motor-driven, on which work is placed.

Evenness and uniformity, as well as thoroughness, of the sprayed coating are responsible for the high quality work of the spray system. Varnishes, enamels, shellacs, fillers, stains, lacquers, japans, and all other kinds of liquid materials can be applied on wood or metal surfaces. The same high quality of work is obtained on the uneven and ornate surface as on the flat, smooth areas, and this without extra effort or slowing up of operations. There is a complete elimination of runs, streaks, fatty edges, brush marks and other similar defects in the sprayed coating.

Spraying finish directly from closed container which is made to safely withstand high pressure.

The speed of spray-painting over the hand-brush method is of outstanding importance. This ranges from two to six times faster, and in exceptional cases it has been known to run up to ten times faster. No time is lost in dipping into the pail, lifting the material to the work and brushing the materials out; the

material is always at the nozzle of the spray gun ready to be released by an easy finger pull on the trigger. This effects a tremendous saving in time and labor, and makes for a more satisfied lot of workmen. The speed of operation also does away with congestion in the finishing room and makes possible a worthwhile saving in floor space.

Healthful and clean working conditions and reduction of the fire hazard in the finishing room result from a proper installation of the spray system. All vapors are confined within the walls of the steel fireproof booth and are completely removed to the outside by the electric exhaust fans. This important feature insures improved and increased production in every case.

Operation is simple and dependable. The equipment is easily adaptable to individual requirements and proficiency in its handling is quickly acquired. The up-keep cost is very little.

A further idea of the adaptability of this modern spray process can be gathered from the wide diversity of manufactured products finished by it. Buttons, shoe heels, camera parts, electrical fixtures, typewriters, musical instruments, enameled ware, all kinds and grades of furniture and automobiles are only a few of the hundreds of those items.

Wood finishers should be willing to devote a certain amount of time and expense to testing out new ideas from a practical viewpoint because, without their cooperation, many good materials and methods would never get beyond the laboratory stage.

Typical Air Compressor Installation for Small Finishing Department.

The time has arrived when practically every finishing department, wherein anything like volume production is expected, must be supplied with compressed air. The cleaning of surfaces before and after finish is applied, the application of finish and the rubbing of varnish—all these operations, which formerly were done by hand, are now performed in a large measure with compressed air, in the modernly equipped industrial plants.

In a furniture factory, where I happen to be acquainted, there are in operation two spraying machines, two pneumatic rubbers and two cleaning guns. For supplying compressed air to operate this labor-saving equipment, the company has installed an Ingersoll-Rand air compressor, having a 5x6 inch cylinder and the capacity for pumping 60 cubic feet of free air per minute when running at 400 r. p. m. The machine is belted to a 7½ h. p. motor rated to run 1750 r. p. m. The compressor is located in the engine room on the first floor, but the supply of air for the compressor is taken from the atmosphere at the top of the three-story building. Air is drawn down through a 6x6 inch wood flue which is adequately sheltered and screened at the top and which extends down over a vertical section of the intake pipe to the compressor.

A heavy 2 inch pipe connects the outlet end of the compressor to the air tank. The limit of air pressure for which the apparatus is set, to allow in the tank, is

90 pounds per square inch and special precautions are taken to prevent the pressure going above this point. One safety feature consists of an automatic spring cut-off valve in a right-angle turn of the supply line to the compressor. This valve is connected with and operated by the air from the tank; a ¼ inch pipe, coming from a connection in the head of the tank, forms the connecting link. When the pressure within the tank reaches 90 pounds

This unit is well located for light and it is properly guarded with pipe railing.

this control valve automatically closes and shuts off the supply of air entering the compressor. The compressor continues in operation but it simply runs "free" when the control valve is closed. When the air pressure within the tank drops 10 pounds the valve automatically opens and permits a supply of air to pass into the compressor.

The automatic safety valve is in a right-angle turn of the 2 inch piping, which connects the compressor to the air tank. This valve functions something like the safety valve of a steam boiler; it is set to release the air at 90 pounds pressure. Therefore if the control valve fails to work the tank will not be blown up because the excess air will escape through the "pop off" valve as fast as it is made.

The valve by which air can be shut off from entering the tank is, purposely, located between the safety valve and the air tank, so that if it happens to be closed some time when the compressor is started, the cylinder head of the compressor will not be blown off. The compressor cylinder is cooled by a circulation of cold water.—R. F. Burwell.

Follow Dipping By Spinning at High Speed.

In some wheel factories the priming coat is put on automobile wheels by a dipping and spinning process. The walls of the dip tank are considerably higher than the level of the paint. In the center of the tank is a verticle spindle which can be raised and lowered; the spindle can be rotated at high speed or quickly stopped still.

The wheel is dropped over the end of the spindle which is then lowered to submerge the wheel in the paint; after submersion the spindle is raised to bring the wheel out of the paint and above the liquid surface. Then power is applied, and the rotating shaft spins the wheel at high speed, thus throwing off all excess paint. The paint thrown off the wheel strikes the sides of the tank and runs back, to be used again. The freshly painted wheel is lifted off the end of the dip-shaft and placed in a portable rack, with other wheels, to dry.

Finishing Furniture in French Walnut

Calling attention to the ideal conditions under which the finest furniture can be given the new light-tone walnut color, and telling in detail how this beautiful effect is obtained in a factory where such conditions do not prevail

By C. C. Herrington

THE nearest approach, to the ideal conditions under which that desirable even-tone French walnut finish (light walnut) is obtained, is found only in modernly-equipped factories that manufacture a high-grade line of furniture. It was from factories of this type that the first showings of French walnut came. The excellent results obtained through the painstaking efforts of their workmen had much to do with popularizing French walnut finish. However, they did more than apply bleaching chemicals and coatings of finish. The desired effect was literally built into the furniture in the white, before the goods ever reached the finishing department.

The face woods entering into all articles to be finished so light in color were carefully selected and matched for color. Thus, the way was well paved for the finisher, and when his work had been well done the finished articles were objects of unusual beauty. French walnut immediately commanded attention; it excited admiration; it created a demand. Furniture manufacturers are now endeavoring to supply that demand. However, very few of them are going to the trouble and expense which is involved in carefully selecting and matching the various parts that enter into the construction of articles to be finished in this light color. Those who manufacture a line of furniture that sells as a "medium high-grade" product feel that they can't afford to do it; the cost would be prohibitive.

So in hundreds of furniture factories one witnesses the spectacle of furniture entering the finishing room to be finished French walnut, and that furniture containing not only different shades of walnut but also different colors of red gum and sap gum—all these in one piece. Who, indeed, is it that envies the foreman finisher—the one man who is held accountable for the final desired result? It is up to him to get as nearly as he can an even-tone bright lustrous French walnut finish—one that will force expressions of praise and admiration from critical buyers.

Do not overlook the fact that such a condition of affairs also makes a nice task for progressive finish manufacturers and their respective service departments, too. To keep in line for present and future business they must work with the finishing foreman in his efforts to solve the new problems that appear when new finishes are introduced. Every progressive individual and every progressive house concerned is thoroughly alive to the problems that are presented through the efforts of all kinds of furniture manufacturers to produce a beautiful even-tone light French walnut,

without a careful selection of the face woods for kind, color, grain and texture.

The foreman finisher of a typical furniture factory that is producing a medium high-grade line of bedroom furniture, recently explained how he is getting out some new suites finished in French walnut. Woods entering into the construction include white sap gum, red gum of different shades and walnut veneered panels, tops, fronts, etc.

"Our first operation," he explained, "is what we call sap staining. A man goes over every piece and stains the light-colored sap wood to bring it up even with the predominating red gum parts. We are now putting through a few suites by a new process. We are using a bleaching lacquer which we spray on. This lacquer raises the grain slightly and when it dries it leaves a very hard surface. After about 24 hours a man goes all over the lacquered surface with No. 00000 sandpaper, sanding it smoothly. Then he cleans it with the air gun. Where there are intricate parts he brushes them briskly with a brush made from several bunches of broom-straw bound together to form a cheap hand broom.

"Now the bleaching lacquer leaves the gum all lighter than the walnut, therefore, to bring up the color of gum even with the walnut, we go over all gum parts with a special spirit stain. This requires some skillful and careful work, because it is the final evening-up process for bringing all parts of the article to uniform color. Next we apply a clear filler, the surplus of which is rubbed off crosswise of the wood grain, with sea moss. We clean the accumulated filler from all inside corners and crevices with the air gun and whisk broom, and wipe the surface clean with a rag.

"The stained, bleached and filled surfaces are now ready for our three-coat finish which consists of one coat of white shellac followed by two coats of good-quality clear varnish. These coats are all sprayed on, the shellac with 70 lbs. of air pressure, and the varnish with 65 lbs. of air pressure. Usually I allow 24 hours between the shellac and first varnish coat, and 48 hours between the first and second varnish coats. We have no varnish kiln, so we allow the last coat of varnish to stand 5 days before we rub it. We could allow less time than five days, but we prefer this length of time for a good quality finish. We rub all flat surfaces with portable pneumatic rubbers, and hand rub the remaining surfaces. The rubbing is done with pumice stone and oil.

"Before trying the bleaching lacquer which we now use, we used a mixed solution which the men put on with brushes. It was an equal mixture of two solutions. One solution is made by mixing 6 oz. of oxalic acid with 1 gal. of water, the other by dissolving 6 oz. of hydrosulphite in a gallon of water, the water in both cases being warm at the time of mixing. These solutions were mixed in equal parts, and the final mixture was kept in glass containers. This process gave good results, but it involved a lot of labor due to the fact that it had to be applied with brushes, whereas the bleaching lacquer can be applied with the sprayer."

Painting Railway Cars With Air Brush

Foreman Car-Painter tells why the railroads adopted the air brush method of painting; describes how it was first used; reveals some valuable suggestions on its care and operation and sets forth some specific figures on comparative cost of air-brush and hair brush methods of painting

By Dennis O'Brien

THE adoption of the air-brush or spray by the railroad companies was not a matter of choice so much as it was a matter of necessity. I can remember when the under-framing of a railway coach or car was never painted, on shopping for repairs or overhauling. The under-framing in those days was wood; bolsters, king-pin frames and truss-rod beams were wood and it was never felt that they required painting.

The introduction of the air-brake, with its intricate network of conduit and pipes, reservoirs, leverage, etc., was the beginning of the steel age in railroads. It was realized that the under-framing must now be painted, and painters were employed to brush on the paint.

On shopping the cars for overhauling and painting, it was discovered that pipes, hangers, and other iron parts had corroded. This oxidation was not caused by poor paint material; it was due to these parts being inaccessible to the hair brush, and not being painted at all. This condition brought about the introduction of the air-brush or spray. It was the only solution of the problem, as air went where hair spent. As one air-brush manufacturer remarks, "air digs deeper than hair."

It soon became evident that the air brush would function quite as well on car bodies as it did on the under-framing and trucks. Here the air brush met with opposition from those who had to do with the painting of the cars. Paint and varnish dry by taking on oxygen and giving up carbon dioxide. When the paint film takes on sufficient oxygen, the film will harden.

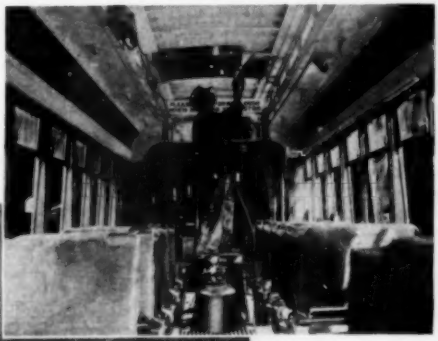
Spraying the sides of a box car.

It was pointed out by those opposed to the spray that the prime factors of corrosion were air and moisture, and as both factors were contained in the air-brush method of paint application, oxidation would be accelerated. The moisture theory was destroyed by one firm of air-brush

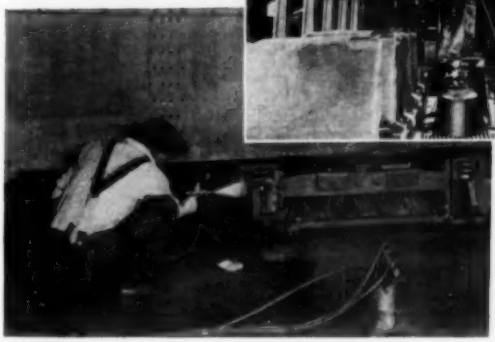
manufacturers who have attached on their spray outfit, a reliable oil and water separator. It has been the good fortune of the writer to have been closely allied with the air-brush for fifteen years, and I say without fear of contradiction that I have never known a case of oxidation due to the use of the air-brush. On the other hand I have seen paint jobs stand up under the air-brush method of application which did not stand up under the use of the hair brush.

car by the air-brush method is $3.50 on piece work rate. This represents a saving of $3.30 per car in labor. Twenty per cent more material is consumed with the air brush, the additional material costing $.74. This leaves a total saving per car of $2.56, by the use of the air-brush over the hair brush.

The air hose and material hose on the first outfit, lasted five months and were then replaced at a cost of $15.00. It would have required two dozen



Below: Painting underneath the car with air brush.



Above: Applying finish coat to ceiling with air brush.

That the spray is a valuable adjunct to the railroad paint-shop has been proven without dispute. For example, the cost of enameling a 28 ft. body, enclosed-vestibule car, with 6-in. oval brush using gum enamel, was $6.80 on piece work rate; the cost of enameling the same style

6-in. oval white bristle brushes, at a cost of $72.00 to produce the same amount of work that the air-brush did in the five months. This makes a difference of $57 in favor of the air brush.

I had three air-brushes operating for one year every working day and each one functioned as

well at the end of that period as they did in the beginning. No parts were renewed, not even a bolt or screw. The only expense involved in their maintenance was the material hose and air hose which we renewed when they became badly worn. It may not be amiss to mention that I have found wire-lined hose superior to the ordinary unlined rubber hose. This is due to the fact that pigments, such as barytes, of a stony nature, act as an abrasive and destroy the unlined hose in a short time.

Let us deviate for a moment from car painting, and glance at some figures by that eminent paint authority, Dr. H. A. Gardner, on house painting with the air brush. Dr. Gardner tells us of a brick house in Washington, D. C.; one portion was done with the hair brush, the other portion with the air brush, the same type of paint was used, 20 lbs. to the gallon. The test showed that on a 100-ft. area the time consumed by the air-brush was 13 minutes; the hair brush, 29 minutes. Wall tests showed 14 minutes for the air-brush and 30 minutes for the hair-brush. On the roof, 100 square feet were sprayed in 5 minutes; it required 16 minutes to hair-brush the same area of space. It is a waste of time to analyze and elaborate on the above figures; they show the true and unbiased economy of the air-brush or spray method.

Much has been said about the air-brush being unhealthy. Such statements are not based on facts. The only health hazard that exists in conjunction with the air brush, is the use of lead paint. Painters colic or lead-poisoning was recognized by the medical profession long before the paint industry ever thought of the air-brush. The remedy for this is to not use basic carbonate white lead.

Where an exterior is to be painted in dark colors, I know of nothing better or more permanent than the pigments composed of ferric oxide. A coating of these oxides is an insurance of rust protection.

Where white or any of the light colors are to be used, let the

Painting the roof with air brush.

base be oxy-sulphate of lead, of which the approximate constitution is, lead sulphate 75 per cent, lead oxide, 20 per cent, and zinc oxide, 5 per cent. For interior whites lithopone is superior to white lead both in opacity and permanence.

To get the best results from the air-brush, it is well to employ a painter or finisher to operate it—not a helper. A painter or finisher who understands his trade thoroughly, can get the air brush to function and produce results that can not be offset by three painters using hair brushes.

Redwood takes finish nicely, even to the silver grey tone so prevalent at this time.

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How to Get a Smooth, Clean Flow of Varnish on High-Grade Work

Pointing out essential requirements that are necessary for the fine, high-grade varnish work, such as one sees on pianos and automobiles

By L. C. Hodgeson

THE demands on the varnish room of today are exacting. The high quality of work produced by automobile varnishers has been a revelation to many piano varnishers who pride themselves with being a class of finishers that always has been looked upon as being superior to others. Especially were those who did "flow" varnishing on pianos considered to be exceptionally fine workmen. But these men had a chance to get away with some work which was not strictly up to the highest quality, because minor defects could be remedied by the fine rubber. Not so with the automobile varnisher. His final coat of varnish is not rubbed; it has to stand inspection the way it leaves his brush, and to do this it must be perfectly clean and smooth — absolutely free from brush marks.

To insure clean varnishing it is necessary to have not only the brushes, the varnish and the surface to be finished perfectly clean and free from all dust, but it is equally necessary that all edges and quirks where the hairs of the brushes may touch, be absolutely clean. If there are any deep quirks or places that cannot be made clean, they should be given a coat of thin shellac to set any dirt that cannot be removed, thus making it impossible for the varnish brush to pick up any foreign matter from the surface being varnished. Shellac, cut as thin as 1 pound of gum to 1 gallon of solvent, is heavy enough for this purpose.

To insure clean surfaces on which to spread varnish it is not enough to dust them off with a duster, because there is always some dirt that cannot be taken off in this way; and unless the duster itself is absolutely clean it is sure to leave some dirt behind. A good way to free the surface absolutely from dirt is to wipe it off with a "tacky-rag." This, perhaps, is a new word for many finishers, so I will explain what it means and how to make one. Take a piece of cheese cloth or other soft cotton rag, and saturate it with varnish, afterward wringing it as dry as possible. Spread it out until the varnish becomes tacky then you have a tacky-rag. Some finishers call it "tack rag." Such a rag that will gather up and retain all the dust and dirt it comes in contact with; it leaves the surface, on which it is used, absolutely free from dust and dirt. A tacky-rag is better made with a slow drying varnish, one that will remain tacky for a considerable time. Adding a small quantity of kerosene or paraffin oil will slow up the drying of the varnish.

A great deal of rough varnishing is the result of picking up

congealed varnish from the inside edges and sides of the varnish container, and spreading it over the surface with the brush. Varnish cups ought to be washed out every night. They can, at least, be put to soak in a solution of caustic soda at night and washed with warm water in the morning. Caustic soda eats away all the varnish from the sides of the cups. Some varnishers use large cups holding 4 to 5 pints each and having a removable cross-bar across the top. The cross-bar is washed off every night. That is good so far as it goes, but it is not so good as washing the whole cup regularly. In any event the finisher should endeavor to keep his brush away from the congealed varnish that collects on the sides of the cup. This jelly-like or semi-hardened varnish does not flow out, but breaks up into small particles which are spread over the surface with the finisher's brush.

Oiled Sandpaper Prevents Scratching.

When sanding between coats of varnish, there is always danger of abrading the varnished surface. To avoid this it is recommended that the sandpaper be soaked in raw linseed oil. The finest grade of paper will scratch more or less. The only reason why sandpaper is used at all is to remove the "nibs" and particles of dust that may have gotten on the surface.

The paper should be soaked long enough to allow it to become saturated; then it should be left in the oil, as otherwise it will become dry and useless. When the sandpaper is required for use, the surplus oil should be removed with a rag. Any oil that remains on the work may be removed by means of a rag wet with benzine; a tacky rag, well known to finishers, can be passed over the work and it will take up everything that is loose, including any oil that the benzine rag may have left behind. The latter contingency, however, is very remote, or should be.

Oiled sandpaper will make some scratches, but these will be very fine and will be completely hidden by the next coat of varnish; scratches made by unoiled paper are sharply defined and not so easily removed from sight. —A. K. Andrews.

Shellac for Rust and Knots.

Nearly every painter has had some experience painting over rusty iron. It may have been painting conductor pipes, water pipes, metal ceilings, or possibly some outside work such as eave-troughing or metal-covered buildings where the metal had become rusted. In any event he probably learned how impossible it is to prevent rust from eating through the paint, especially if it is a delicate-colored paint. If all rusted spots are given a coat of orange shellac before applying the paint, the shellac will neutralize the action of the rust and prevent trouble from this source. All loose rust should be scraped off before the shellac is applied, to prevent peeling. If it is outside work the shellac ought to be painted over as soon as possible after it is dry in order to prevent it being injured by the weather.

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Be sure that the shellac used for neutralizing rust is pure shellac. A great many substitutes for shellac are on the market, and, if you are not an expert judge of shellac, you are likely to be deceived unless you are buying from a reliable house. Many painters have trouble with the shellac they use over pine knots; the reason is that the shellac is not pure, if indeed it is shellac at all. For the average finisher, the only reliable guarantee that shellac is pure, is the reliability of the manufacturer. Remember this when buying shellac.—J. J. Feeney.

Applying Gold Leaf to Carvings.

When preparing to put gold leaf on carvings, the first thing to do is to apply two or more coats of shellac to the surface of the carvings, sanding each coat smooth before the succeeding coat is applied. The last coat ought to be applied very smoothly to obviate the necessity of sanding, as carvings are very difficult to sand without cutting through at the sharp edges. The reason for putting on shellac is to prevent the wood from absorbing the sizing, which holds the gold leaf in place. If any edges are cut through when sanding the shellacked surface, the sizing will be absorbed by the wood and the gold leaf will come loose at these points.

After the shellac foundation has been built up, apply a coat of gold-leaf sizing. This sizing can be bought ready prepared. Some finishers make a sizing from boiled linseed oil by exposing the oil to the air in an open can until it becomes fatty; when in this fatty condition it will remain tacky for a considerable time after being applied to the wood. The prolonged tacky condition of sizing is necessary to enable the workman to get the gold leaf in place before the size becomes too dry. Do not try to lay the gold leaf until the sizing has become tacky; the length of time required for this condition to develop depends on the condition of the sizing. A finisher must watch it and use his own judgment. Here as elsewhere experience leads to better results.

Gold leaf is laid with a long camel-hair brush, made especially for the purpose. Cut the gold leaf to the required sizes before starting to lay it. Holding the brush in one hand brush the dry palm of the other hand briskly in three or four strokes, as though cleaning dust from a new brush. This has the effect of magnetizing the hair so that it will pick up the gold leaf. Touch the end of the piece of gold leaf with the ends of the brush bristles and lift it up, placing it where it is to lay and pressing the gold leaf gently so as not to break it. Where joints occur allow the gold leaf to lap slightly. The thin gold will stick wherever it makes contact with the sizing; the surplus can be carefully wiped or brushed off.

Laying gold leaf is an art that cannot be learned in a day, but if one has patience and perseverance and some natural ability for this sort of work, there will be no serious difficulty about learning it in due time.—W. C. Mack.

Baked Enamel Process for Auto Finishing

Substantial progress has been made in the past year in the development of improved finishing materials for automobile bodies. Hitherto the need for speed in production has made black the standard color, although many purchasers prefer other tints

By W. L. Carver*

A RECENT development in color finishing on a production basis is noteworthy, as the desirable sales aspects of brighter colors are combined with the manufacturing advantages of the asphaltic enameling process. The Olds Motor Works is finishing its sport touring model in a weathered-bronze green by a baked enamel process. The process is more noteworthy as but little variation has been made from the routine of the black enameling department and the same equipment is used. With the exception of one slight variation, the same steps are followed in a common department. Development of material rather than equipment has made the process commercially possible.

In the new material, the base is China wood, or Tung oil, which comes from the seeds of a tree common to China and known as the varnish tree. This tree is of the same natural order as the castor bean, candle nut, and others, most of which produce semi-drying oils. However, in this case, the product is a drying oil which is high in lac, extremely durable, of a high degree of penetration and adhesion, and capable of withstanding much higher temperatures than the usual drying oils. Under ordinary conditions this oil absorbs oxygen rapidly and takes the form of a hard, flexible surface or coating. This action is accelerated by the high temperature and copious air supply of the ventilated type of oven.

Following the selection of an oil of this type, the next major problem was the pigment or color-producing element. It finally developed that the pigment must be in thorough solution and have little or no solid characteristics. Following this line, the pigment is triple ground and baked and then put into solution with a carrier and clarified. The solution is then allowed to settle and only that portion which remains in solution is mixed with the oil. The solid portion which settles out is reprocessed. In addition to the weathered-bronze green which is already in production, shades of red, blue and green have been developed.

In production, bodies leave the end of the line in the body building department, which is adjacent to the enameling line. At this point they are placed on individual carriages and thoroughly cleaned with gasoline and sand-paper. No commercial

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cleaning compound is used here, as the bodies are built entirely under one roof, the stamping department, body building line and enameling department being in close proximity. As all of the metal parts, as well as the assembled bodies, are processed rapidly through the various lines, little opportunity for rusting or corrosion is offered.

Each body on its carriage is then run into a drain deck, where the priming coat is flow-coated on in the usual way. This coat is very high in oil, the percentage being 87, and fairly low in pigment. As the oil is highly viscous, additional draining time must be allowed before the body enters the oven. Therefore, the body remains on the draining deck for a period of 12 min. and then is placed on the conveyor line, where a further period of 20 min. intervenes before entrance is made into the oven.

The 12-min. stationary drying period is required, as these bodies are handled on the regular black enameling conveyor line, which is timed for the 20-min. draining period. A maximum temperature of 360 deg. F. is maintained, and 100 min. are required for the body's travel through the length of the oven. The ovens are of the tunnel type, being arranged in parallel banks, and both heated and ventilated in sections. The furnaces are oil-fired and the circulating air is passed through an air washer. The temperature at each section of the oven is maintained by electrical equipment.

Upon emerging from the oven the body is given a light sanding operation and is spot-puttied to correct all slight irregularities. This operation requires about 3 min. and is performed on an extension of the oven conveyor line. The flow-coating operation is then repeated, being followed by the same drying periods on the deck and line, 12 min. and 20 min. respectively. This coat contains a reduced percentage of oil, but an increased pigment content, forming the undercoat. Following the routine of the first baking the body again passes through a 100-min. period in the oven at 360 deg. F.

After this baking the body is rubbed with wet or dry sandpaper and water and then is

Spraying finish on automobile body.

sponged and cleaned off with chamois skin preparatory to the final coat. The body is then returned to the draining deck for the final flow coat, which is followed by the former draining conditions and time periods. In order to improve the luster the pigment content of this coat is greatly reduced and is augmented by the addition of a copal gum, a colorless resinous product which provides a bright, highly durable finish. The body then remains in the oven for 130 min.

at a maximum temperature of 250 deg. F., after which it is striped and delivered directly to the trimming line.

In tabulated form the routine from delivery to the enameling department to delivery to the trimming line is as follows:

1. Clean with sandpaper and gasoline.
2. Flow on priming coat.
3. Drain, 12 min. on deck and 20 min. on line.
4. Bake at 360 deg. F. for 100 min.
5. Sand and spot putty.
6. Flow on undercoat.
7. Drain, 12 min. on deck and 20 min. on line.
8. Bake at 360 deg. F. for 100 min.
9. Sand, using wet or dry sandpaper and water, sponge and wipe off with chamois skin.
10. Flow on finish coat.
11. Drain, 12 min. on deck and 20 min. on line.
12. Bake at 250 deg. F. for 130 min.
13. Varnish stripe.

This routine is no more complicated than that of black enameling of equivalent depth and quality and the total production time is well within 9 hours.

From the handling angle, both in the shop and in service, this finish has been put through the most severe tests and has been required to fulfill all of the demands which are met by the asphaltic black enamel. Cars finished by this process were put in continuous operation on the road under all conditions. The finish was deliberately neglected and then cleaned in the crudest way. Bodies were placed on the roof of the plant to undergo the full effect of varying weather conditions.

The pliable characteristics of the finish were tested by denting the body and bumping out the depressions. In all of these tests the finish has demonstrated its general quality in a marked degree and apparently has the permanency and durability which have long been associated with black enamel. Colors which have practically the same luster as a varnish finish retain this quality indefinitely, and any minor scratches acquired in service can be effaced by rubbing and polishing.

High-lighting Furniture Carvings.

To make wood or composition carvings on finished furniture stand out clearly and beautifully, instead of appearing as so many dark, even-colored masses of irregular and indistinct roughness, requires high-lighting—making the high places lighter in color than the low places. The high-lighting effect usually is fixed during the staining process. Stain is applied quickly and immediately wiped off the high places of the carvings.

If it is not convenient to employ the method just mentioned, then stain in the usual manner, that is, evenly all over, and after the stain has become thoroughly dry, go over the high places of carvings carefully and lightly with No. 0000 sandpaper to lighten them up.

Linseed oil is obtained from flaxseed or "lin"-seed which comes from the flax plant.

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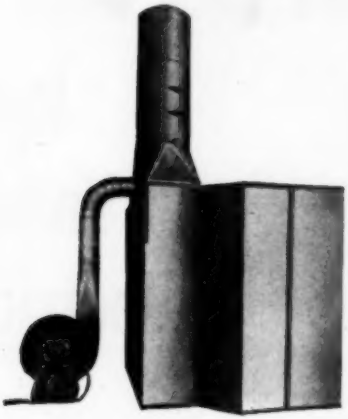

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Table Parts Go Through Finishing Room on Special Racks

How one furniture manufacturer has speeded up production in the finishing room, through the use of portable racks of special design and construction

By M. J. Severn

REALIZING that production can be increased and better work performed at less cost in the finishing room when suitable provision is made for handling, transferring, and temporarily storing the material being finished one concern, that manufactures small K. D. tables, has developed special portable racks as a solution of its problem. Each table entering the finishing room in the white, is in the form of five separate units—a top with rim and corner blocks in place, and the four legs each with a corner bolt in place.

Tops are removed from millroom trucks, cleaned with an air gun, stained, filled, rubbed and

Fig. 1—Removable shelves make the rack adapted to carrying articles of different sizes.

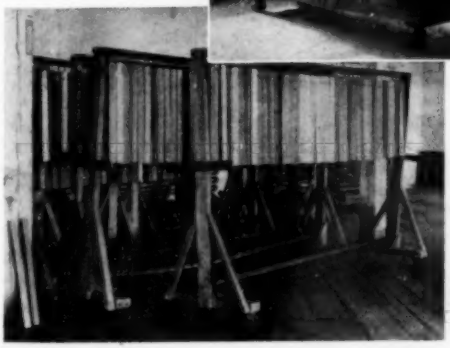

Fig. 2—Squares hanging corner to corner from horizontal bars on skeleton type of portable rack.

piled on a portable rack, like that appearing in Figure 1. Throughout the remainder of the finishing process the tops are handled to and from these portable racks. The upright ends of the table-top racks are cleated for shelves, so that the racks can be used for carrying larger articles by simply removing some of the shelves to make larger spaces available. Each rack has four 2-wheel swivel casters (one on each corner), therefore it can be moved easily in any direction.

The square table legs are handled somewhat differently. In the top end of each leg, a small staple is driven to permit hanging the leg to a hook in the horizontal bar of the rack. The arrangement of hooks and staples is such that 40 square legs hang corner to corner and close together from a horizontal beam which is supported by two uprights. The skeleton base of the rack is fitted with 2-wheel swivel casters, the same as the racks for table tops.

The table-leg rack is run partly inside the spray booth and the spray operator sprays the square legs, first from one side of the rack and then from the other. In doing this he covers all four sides of each leg, because he can reach two sides of each square from one side of the rack, and the opposite two sides from the other side of the rack. After the table legs are completed and have become dry, the staples are withdrawn from the ends and used over again.

These racks afford protection to the material in process and they save space, time and labor. They are easily built at very little cost, and once built they can be adapted to carrying several different kinds of articles.

Finishing Piano Keys.

Black piano keys have the appearance of ebony, but most of them are made of birch, which is dyed black, birch seeming to take the dye better than most other woods. By the present method the wood is allowed to soak in water for 15 hours, after which the keys are taken out and placed in the dye, in a steel cylinder vat; here they all are kept under steam pressure of 10 lbs. for 24 hours. The keys are not removed for another 24 hours; in the meantime the dye has cooled down; this is to prevent checking of the wood in drying. They should be dried in a kiln, starting with high humidity and gradually lowering the same until the wood is dry.

After the drying the next step is to sandpaper them on a belt sander, finishing with fine paper. Finally, they are polished on a buffing wheel driven at high speed. Graphite, on a felt or cotton buffer, is employed in the final polishing operation. Then they have the appearance of fine ebony wood.—K. A. A.

Suggestions for Graining.

Finishers who are making what is known as "surfaced oak," sometimes have trouble with the finish chipping off immediately above the graining material and carrying the grain with it. There may be several causes for this, but there is one sure remedy, and that is to do the graining on the

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Wood Surface

It is first, highly essential to have the wood cut down to a smooth even surface as free from depressions as practical. Time and care spent in surfacing the work is money saved in the end since fewer coats and less rubbing are required for well surfaced wood; and the finished result is always better. It is very essential to thoroughly clean the dust from the pores after sanding, as an accumulation of dust will prevent the wood from taking the filler and also absorb moisture from the stain giving rise to poor drying and generally unsatisfactory results.

Staining

Water Stains are preferable for use under Lacquer. Because of the composition of most oil stains there is constant danger of the colors bleeding when used under lacquer. Oil Stains frequently slow up the drying of lacquer and prevent proper knitting to the wood even though shellac is used before applying the lacquer. Lacqueroid System Water Stains give perfect results for lacquer work, and are supplied in powder form ready-blended to any desired shade and require only the addition of water.

Paste Filler

Practical tests over a period of years have proved that for best results with lacquer it is necessary to use a special type of filler. Glidden's No. 400 line of paste wood fillers has been specially designed for use under lacquer. These fillers will not shrink, turn gray, "cut up," or become mushy in the bottom of the pores. No. 400 fillers are made in all standard shades, and are used in the same manner as any high grade fillers. Great care should be exercised to see that the pores of the wood are filled flush with the surface of the wood.

We believe that a finish produced under the Lacqueroid System has no equal for beauty and permanency. Both laboratory and shop tests have proved its durability beyond question.

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By the Lacqueroid System

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After the work has been surfaced stained and filled it is ready for the finishing coat of No. 35 Wood Lacquer — the number of coats depending upon the finish desired. No. 35 Lacquer sprays and levels perfectly and dries quickly to a hard tough film that is very full and rich. It is not affected by exposure to ice, live steam or hot dishes — it is proof against heat or cold. The scuffs and abuses of everyday use have little effect on No. 35 Lacquer. The film is absolutely waterproof — the most durable and permanent finish known.

Undercoater

(Where Varnish Finish is Desired)

The same properties that have given No. 35 Wood Lacquer its great popularity as a finishing material also make it an exceptionally good undercoater for varnish — where a varnish finish is desired. A finish built up with No. 35 Lacquer as an undercoater and finished with rubbing varnish has much greater toughness, durability and fullness than if shellac, shellac substitute or varnish undercoats are used. This fact has been conclusively proved not only by our own tests but by the experiences of many of our customers.

Varnish Finish

(Where Lacqueroid Undercoater is Used)

To produce a built up varnish finish the surfacing, staining and filling are done as described above, using No. 35 Wood Lacquer as an undercoater. Two or more coats of Tuskcote Rubbing Varnish are then applied. Tuskcote flows and levels out perfectly and for this reason is easily and quickly rubbed. It dries rapidly to a hard print-resistant finish but is not brittle. Tuskcote can be either brushed or sprayed, air dried or force dried, dull rubbed or polished and gives a very full, clear tone. It is the ideal rubbing varnish.

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bare wood. The usual method is to first seal the wood with a coat of surfacer, and grain on top of this coat. Of course when the graining is done by hand and it is necessary to do blending, it is usually necessary to first seal the wood to prevent rapid absorption of the graining material. But when the graining is done with a machine and no subsequent blending is necessary it will be better to grain on the bare wood and put the sealing coat on top of the graining. When the graining is done on the bare wood it will never chip off. The sealing coat will be just as effective in preventing the color coats from showing up the natural grain of the wood, when it is applied after the graining, as it is when applied before.

A good way to grain piano stools that have turned legs is as follows: Mix in one pint of vinegar a sufficient quantity of sugar to make a very thin syrup. Add to this syrup a sufficient quantity of burnt umber to give the desired color for the grain. The best grain for the beginner to start with is burl walnut, because it is the easiest to make on turned work. To apply the color use a coarse sponge. Saturate the sponge with water, then squeeze it as dry as can be done by hand; put a little color on one side of the sponge with a brush, and with the sponge gently tap the leg. With practice and the right kind of a sponge one can learn to make a splendid imitation of burl walnut. After the graining material has been put on dip the stools in linseed oil thinned with turpentine or benzine, or a mixture of the two, with some driers added. The oil and driers will seal the pores and prevent the color coat showing up the grain of the wood. The color coat can then be applied with a brush or spray, but the varnish coat can best be applied by dipping. A good color coat that will hold up a coat of varnish to perfection, can be made as follows: Mix together 1 quart of good varnish and 1 pt. of brown japan. Into this mixture sift 1 lb. of finely-ground and bolted silex. Add whatever coloring is required to color the artificial grain. Let the whole mixture stand twenty-four hours; then thin to the desired consistency and it is ready for use. It can be used quite heavy on turned work, so that very little thinning will be necessary. Be sure and use pure silex as this is more transparent than any of the other pigments. This coat ought to dry flat, but it must not be cloudy after the varnish is put on. If it is cloudy use less silex; if it dries with a gloss, or even with a sheen, use more pigment. This coat ought to be dry enough to varnish over, in from twelve to fifteen hours.—J. B. Chipman.

Buffing.

The polishing of small enameled wood articles is frequently done on a buffing wheel composed of built-up layers of heavy cotton cloth. The wheel may be, say, 10 inches in diameter, 1¼ to 2¼ inches thick and should run at about the same speed as a grinding wheel of similar size. A buffing composition known as "Tripoli" is often used on the face of the wheel to make it more effective as a polisher.

Industrial Finishing

PRACTICAL PUBLICATIONS, Inc.
Publishers.
210 Holliday Building
Indianapolis, Ind.

Issued monthly. Distributed exclusively to executives and foremen finishers in all kinds of industrial plants where finish coats are applied.

NOVEMBER, 1924

Finishing by Machinery

The application of finishes and the rubbing or polishing of finishes on both wood and metal surfaces, present almost unlimited possibilities for the use of machinery. Where volume of production justifies the employment of machinery, there is little occasion for any hand brushing or hand rubbing in the finishing rooms of modern industrial plants. Finished materials are mixed by machinery, articles to be finished are delivered to the finishing room mechanically and are advanced from one process to another by conveyors or trolleys, or some mechanical means especially suited for the occasion.

Cleaning the surface, preparatory to the application of the first coat, is performed mechanically by electrically operated brushes, or by compressed air guns, or with something else that is particularly adapted to the work at hand. Dipping, spraying, flowing on and tumbling apparatus are available for the application of all kinds of coatings. As a matter of fact it appears that in large production factories, practically the only work done by hand is the rubbing off of filler from woodwork, the spreading of paste filler, with a putty knife, over certain kinds of metal work (for example, automobile body work) and the rubbing of irregular varnished surfaces.

Rubbing the varnish on flat surfaces is performed by portable pneumatic or portable electric rubbers, or by mechanically operated pads on large reciprocating machines. Stenciled figures often are sprayed on, but striping still remains a strictly hand brush operation. Drying and baking of finishes are accelerated by various mechanical means.

In the operation of finishing room machinery, compressed air, electricity and steam all play important parts. All the spray guns and some types of portable rubbers are air operated. The small heaters that maintain finish materials at correct temperature and the fans, that remove fumes and wasted spray from the spray booths, are electrically operated. Some types of portable rubbers also are electrically operated. The heat for drying or baking is supplied by steam, electricity or gas. The purely mechanically operated apparatus, such as conveyors, agitators or mixers, fans, lifts, etc., may be connected to whatever source of power happens to be available in the plant.

Metal Finishing

The materials and methods involved in high-grade metal finishing have an interesting future. Not only are there opportunities for improving the finishes and

methods for coating the increasing quantity of things that have always been made of metal, or the new things that we naturally expect to be made of metal, but countless opportunities also are afforded to devise better materials and better means for coating and decorating the surfaces of many metal articles and surfaces which heretofore have been made entirely of wood.

Sash, doors, interior trim, paneling and even office and household furniture are now offered in various finishes in metal. Many of the high-grade articles in this new array of metal work are finished in a natural wood-grain effect, which appears so real that it might defy detection, were it not for the tell-tale ring, when it is lightly tapped with something hard. Some beautiful examples of metal "woodwork," finished in walnut and mahogany, are found in Pullman cars, elevator cages, bank and store fixtures and along the corridors of fine, modernly-equipped, fireproof office buildings, clubs and hotels. Some of the metal furniture is also finished in natural wood grain.

Where a wood grain effect is not used or desired, the surfaces usually are enameled in some color and possibly striped to imitate inlay, or stenciled or decorated with hand painting. Later the enameled and painted surface may be given one or two coats of clear varnish to give it lustre and to preserve it against possible discoloration, defacement or other damage. The gradual replacement of wood with metal in certain classes of products has prompted a number of manufacturers to do considerable laboratory experimenting with the idea of bringing out finishing materials which will meet the various problems in metal finishing as they arise.

The quality of metal enamels, for example, calls for entirely different technology than does the wood-working field. The first coats must cling without depending upon penetration. The finish must be very elastic to stand the contraction and expansion of the metal. It must stand baking in some cases and air drying in others. It is evident therefore, that the metal field is an entirely separate one from the wood-working field; the initiative and adaptability of technical men connected with the manufacture of finishes, and of practical finishers, who must apply the finish, will have much to do with the future development and success of the art of modern metal finishing.

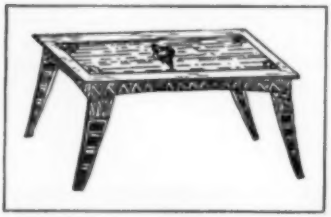
Small wood turnings are frequently finished in tumbling barrels. Barrels in which finishes and oils are shipped often serve for this purpose. When the barrels become too thickly coated inside after long service, they are replaced with new ones. Those in the above picture are belted directly to lineshaft above.

Period Finishes—Egyptian

Describing characteristic colorings and designs of ancient furniture of the Nile Valley, and how Egyptian decorative effects can be applied to modern furniture

By R. J. Meade

THE excavation of the tomb of King Tut last year, and the consequent stimulus of interest in things Egyptian, reminded us rather forcibly of the adage, "nothing new under the sun." To those engaged in building and finishing furniture it was rather a jolt to discover that as long as 3,000 years ago there existed a people in the Nile valley highly skilled in joinery, carving, veneering, inlaying and painting. We know this, not from books or from legend, but from actual examples, sturdily constructed, bright in



A coffee table painted and decorated according to Egyptian style.

colors and beautifully preserved by the wonderful climate of the country. Mural decorations inside the tombs show clearly how workmen of the day with crude tools, mortised, glued, cut and laid veneers, and painted with reed brushes.

The surviving pieces indicate that, with these crude tools and methods of color mixing, the Egyptians were able to provide finishes of astonishing fineness, artistry and endurance. Red, yellow and blue earth colors were combined in a variety of shades with the white of an egg or perhaps honey, and over the painted design was applied a protective coat of a gum lacquer, most likely derived from the Tragacanth tree. Sycamore, cedar and ebony were the woods used, often inlaid with ivory or gold.

Present day reproductions in both form and finish very naturally require a great deal of compromise. A typical example would be an occasional table or a nest of tables finished as follows: A coat of finely-ground primer tinted a light or turquoise green, sanded and followed by a body-enamel coat, semi-gloss, of the same shade. The leg turnings are now banded with dull red, green, yellow and possibly black in alternate succession. Running around the frame under the top will be characteristic Egyptian stripe or animal symbols in the same colors. The whole is finished over with a flat varnish.

Where walnut, the universal wood of this season, is used, the Egyptian style is carried out in the design and in polychromed ornamentations. For instance, two paralleled dogs (Anubis) supporting between them a flat panel, constitute a coffee table. The whole is stained with oil or water stain of the same shade as American walnut or darker, filled with walnut paste wood filler, given a

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coat of shellac and two coats of dull rubbing varnish or lacquer. The eyes, nose, ears, mane and muzzle of each dog is picked out in red, yellow and green Japan color, antique glazed with burnt umber and a little Van Dyke brown in shellac. The center of the table bears a punched design into which the same colors are wiped and glazed over.

These represent two good examples of furniture types brought out by the King Tut vogue, and the manner in which ingenious finishers reconciled methods thirty centuries old with current decorative and protective requirements. The effects were novel and arresting yet entirely in keeping with good taste.

Painted, Stippled and Antique Enameled Furniture.

For several years back, antique-enameled and stippled furniture has been popular, not only for the bedroom but every room in the home. This "glazing" or antiquing, as it is known by the decorator, has appeared mostly in the higher class of painted furniture. Many beautiful painted suites of today are reproductions of old pieces of years ago.

There are several different methods of antiquing. One way is to coat the piece with the glaze color, and then stipple out until an even color is obtained. Another way is by wiping the piece all over, using a clean rag or bit of waste and wiping off nearly all of the color. Still another method is by running the beads, mouldings, etc., full of color and wiping nearly all out dry.

Many manufactured glazing liquids are on the market today. In this work oil, turpentine and dryer will do good work, drying and flattening out well with little gloss. Too much dryer or turpentine in the mixture will cause the liquid to dry faster than it can be used. For stippled effect, use a large stippling brush for large surfaces; elsewhere an old stubby paint brush will work fine. Best results can be obtained by applying a thin coat of shellac over the ground coat to keep the color from setting too fast. Where the furniture is decorated, the decorating and striping are done before glazing to give an aged effect to the decoration.

A beautiful old ivory can be made with a ground composed of white chrome yellow with a touch of black. This should be just off of the white. For a glazing color, raw sienna, burnt or raw umber to a desired shade. To get an aged effect this should be wiped nearly clean or stippled out very thin. A darker ivory may be made of chrome yellow burnt sienna and black. This is a good ground for a plain stipple with a glaze of raw sienna and umber. This may have an over-glaze of green or blue applied in the same way.

A blue ground can be made of white and Prussian blue. Prussian blue and chrome yellow, kept very light with an over-glaze of raw sienna and umber stippled out or wiped off, makes a Venetian green. Darker and deeper blues may be done in the same way. These combinations are suitable for furniture in almost any room. Others consist of a bright yellow ground with sienna

and umber glaze; also a ground made of vermillion, raw sienna and chrome yellow, with an overglaze of Van Dyke brown or burnt umber. All shades of gray may be done in the same way. For breakfast room suites, a flat ground is necessary. Clear lacquer, French polish, or either gloss or flat varnish may be used as a finish.

The finisher can work out many beautiful effects along this line according to his own ideas. This class of furniture will no doubt stay in style for a long time, especially in the breakfast-room line, as every up-to-date home has one. Close-grained wood, such as maple and birch, are the best for painting, as there is no filling necessary, and the work can be finished cheaper. In some of the higher grades of painted furniture American mahogany is used, leaving the pores open and rubbing the glaze in. Oak can be treated the same way for obtaining the aged effect.—J. K. Cooper.

Some Rubbing Troubles.

Usually the varnish is blamed for any trouble that arises in the rubbing, but the trouble may be placed elsewhere, in many cases. Varnish-rubbing trouble sometimes occurs when the best of varnish has been used and when the best of skill has been exercised in the rubbing. One of these troubles is due to the varnish not having been dried perfectly before the rubbing was started. In this case the soft varnish will adhere to the pad, and the surface of the work will be damaged. The technical term for this is caking.

If insufficient water is used during the rubbing there may be caking. Other causes are poor-grade pumicestone, too much pressure on the rubber, poor kind of rubbing felt, etc. Some finishers add a little soap to the water, thus making a slight suds to prevent caking; they claim that varnish may be rubbed at an earlier stage, or when greener. A bit of pulverized rottenstone added to the pulverized pumistone is said to prevent caking of the varnish on the pad. Coarse felt will not cake as readily as fine felt, this being due to the fact that the coarse pores do not close as readily as the finer ones.

Considerable heat is generated when rubbing is in process, on account of the friction, and this is often enough to soften the varnish surface, making it quite easy for the pad to cake. This, however, can be prevented by using plenty of water or rubbing oil.

There is another cause for this trouble, one that is not often suspected. If a thin skin is allowed to form on the varnish before it is applied it will break up into very small particles, and the rubber will pick up these particles because they do not dry hard like the smooth surface.

Some pumices work like clay; they cake up naturally on the rubber. Others of low grade contain grit which will scratch and damage the surface. The inference is obvious; use only the best if you expect the best finish. If a rubbing machine is used, see that the pads do not generate too much friction as they move over the work.—Paoli.

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Spraying Metal in Atomized Form

The chief reasons for coating so many metal surfaces with a different kind of metal are to afford protection against corrosion or oxidation, and for the decorative effect

A PROCESS and apparatus for simultaneously melting, atomizing and applying to any surface, coatings of metal, are being featured by the Metals Coating Co. of America, Philadelphia, Pa. Originally conceived as a means of coating iron and steel with lead to provide protection against atmospheric corrosion, the Schoop Metal Coating Process, as it is called, is said to be developed to the point where any of the commercial metals, either in wire or dust form, may be applied to nearly all kinds of materials.

Three methods of utilizing the process are available, each possessing particular features in its respective field of application, as follows:

1. The "Metalayer," which uses metal in wire form of the standard commercial gauges and with which coatings of copper, brass, bronze, German silver, aluminum, zinc, lead, tin, iron, nickel, monel metal, and various alloys of the same may be sprayed.

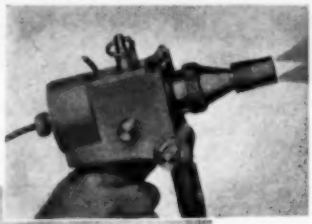
2. The "Gravitas," which uses metal in the form of dust, with which zinc, aluminum, tin and lead are usually handled.

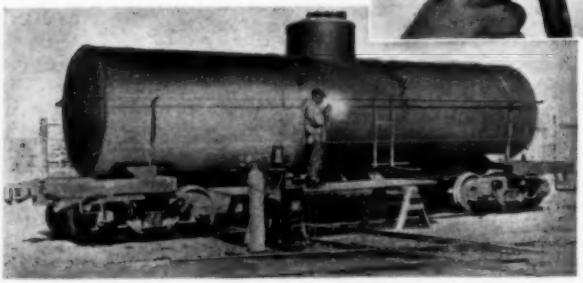
These two types are adapted to coating individual pieces of any size and at any place, one at a time.

3. The "Mass coating machine," a combination of either one of the above, with a specially constructed tumbling barrel and with which articles, weighing from a fraction of an ounce up to 10 lbs. each, may be treated in lots of approximately 100 lbs. at a time.

The "Metalayer," or spray gun that uses wire, is connected to standard acetylene and oxygen cylinders, and to a supply of compressed air. While in use it consumes approximately 15 cu. ft. each of the gases per hour, and 50 cu. ft. of air per minute at 50 lbs. air pressure. Metal in the form of standard gauge wire is automatically pulled from a reel into the rear of the gear case, and fed uniformly and continuously at a rate of from 12 to 24 ft. per minute to the muzzle of the short barrel: here the wire enters into a continuous reducing flame zone developed from the gases and air. The wire is melted and blown, at a velocity of about 3,000 feet a second, in a very fine spray onto the surface being coated.

The mechanism within the gear case consists of an air-driven turbine operating a wire-feeding and straightening device for leading the metal into the barrel. The wire remains unchanged until it emerges from the muzzle, at a point about $\frac{3}{32}$ in., from which it is melted and transformed into a fine spray.





Coating the side of a tank car with rust-proof metal by means of "Metalayer" spraying apparatus. Insert at right shows close-up of the spray gun.

The muzzle is pointed toward the surface to be coated and held within 3 or 4 in. of it. In this short distance the metal wire is changed to hot atomized spray and then back quickly to a solid state, but in the form of a thin permanent film over the surface being coated. The temperature of the surface being coated is only slightly raised—so slightly, in fact, that the head of an old-style match can be coated without igniting it. Thin paper, fabrics and wood are sprayed without charring. A single coating is about .001 in. thick. Five inches from the muzzle the spray covers a circle approximately 2 inches in diameter.

The "Gravitas" which uses metal in dust form consists of a cylindrical container which holds about 20 lbs. of the powdered metal. A removable cover at the top is fitted with a pressure gauge; at the bottom is an ingeniously constructed dust distributor. From the distributor the dust passes through a rubber tube to the spray gun. In the gun the dust is forced between two concentric flame zones at the muzzle, where it is instantly heated to a plastic state and impacted on the surface being coated. On account of the metal being already atomized (in dust form) a greater quantity can be heated to a plastic state in a given time by the flame, and less gas and lower air pressure are required to impact it.

Burning In Shellac Electrically.

The electric soldering iron is coming into extensive use for burning in stick shellac to build up dents, or fill cracks and marred or defective places on the surfaces of completely finished articles. For this service the shank of the tool is fitted with a round steel prong, which is

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slightly flattened on one side, cut off square at the end, and given a gentle bend something like the tang of a fork, so it can be easily applied to the work in several ways and at different angles.

French Polishing.

French polishing is a process of "bodying up" your work with thin shellac applied with a pad dipped in raw linseed oil. The pad is made from fine cheese cloth or muslin and a wad of cotton. Take a large piece of cotton, dip into oil and squeeze it nearly dry, then dip in shellac and squeeze out the surplus: wrap a cloth around it to make a pad.

After the wood is filled, stained and sanded, a coat of shellac is applied with a fine brush. When dry it is sanded again with fine sand paper or steel wool. Now the work is ready for padding. Dip the pad in shellac and wring it nearly dry; go over the entire piece any number of times, or until a fairly good body is obtained. Then let the finish harden, afterward sanding it a little. Brush coat again and then pad up to a finish. The more padding that is done, the more beautiful will be the finish. Care should be taken not to use too much linseed oil in padding, as it will cause the shellac to require more time to dry, and often times it will leave the shellac soft. After the surface is thoroughly dry, "dull off" with pumice stone and oil. Rub the surface over with the oil, sprinkle on the pumice and brush off with a polishing brush, cleaning the surface afterward.

This finish may be used on any kind of hardwood where a clean, beautiful finish is desired. It also can be used on painted work, going at it in the way as just described. It gives a finish which is harder than enamel and less liable to chip. In this work the pure bleached shellac must be used so as not to discolor the tints. Don't allow the shellac to remain exposed to the air too long, as it will discolor and turn yellow. Dull rub the painted work in the same manner as hard wood. Orange or white shellac may be used for hardwood work, cutting it nearly half or better.—J. K. Cooper.

First Coatings for Fibre Furniture.

In preparing fibre furniture for the ultimate coats of varnish, it is the practice in many factories to first apply a very thin solution of cold glue as glue size and then, when this is thoroughly dry, apply water stain. Often both of these coatings are put on by the dipping method, but in small operations they are brushed on. The stain can be sprayed on, if a spraying outfit is available. When stain is applied with a brush, two thin coats will give more uniform color than one heavy coat.

The decorative effect on modern enameled breakfast-room suites is usually obtained either by striping or stenciling. Paint seems to be preferred rather than enamel for this decoration.

Never keep orange shellac in a tin or iron vessel. Iron discolors the shellac and makes it unfit for use on delicate colors.

A Refinish Job on Bank Fixtures

How the original light oak and later refinish coats, were removed from a set of cypress bank fixtures, and the surface prepared for the application of a Flemish oak finish

By J. W. Crout

IN a certain Texas bank the fixtures, and panel work extending 4-ft. high around the walls, were cypress. They had originally been finished in light oak, and then refinished some years later with a varnish stain over the light oak; then varnished with a cheap varnish, costing about $1.00 per gallon. The finish was still "tacky" when two local painters were called in to see about refinishing it like some other bank the president had seen. He wanted a Flemish oak—"a real dark oak." The painters who had been called in, didn't care to attempt the job. Finally, I was called in. I took the contract, not only for refinishing the fixtures, but also the hardwood floors, the walls and the ceiling.

It was necessary for me to work fast because the bank was obliged to move out and occupy temporary quarters while I was engaged on the job. The first thing I did was to get some brushes with 18-in. handles. I made a solution of lye by adding 12 cans of Merry War lye to 8 gallons of water. With this equipment I scrubbed the whole thing until all the old varnish came off. In passing, let me remind you to never use lye solution on slab-sawed oak (plain oak) unless you want a very dark finish, in fact almost a black.

After removing all the old varnish I rinsed the wood four times, first with boiling water, into which 1 lb. of salt is well dissolved into every 8 gallons of water. The salt will keep the wood more to its natural color. Follow with clear, cold water, preferably rain water, as this will prevent the lye from eating into the wood. One must be sure to use a putty knife or a pointed knife and scrape thoroughly in all inside corners, seams and edges. Twenty-four hours after this treatment I used regular varnish remover on any spots that remained. When one is scrubbing and rinsing, it is necessary to work as fast as possible, so the wood will not soak up so much water that will swell and warp and perhaps burst some joints. Never use this method on any veneered work. I will describe my method for treating veneered surfaces at some other writing.

The panels were to be Flemish oak, and the framing strips or panel borders were to be mahogany. When the woodwork had become thoroughly dry (after 72 hours), I sandpapered the panels with No. 1 sandpaper and the framing strips with No. 0. With the woodwork all sanded down smoothly, I began work with an acetylene blow-torch, using it only on the panels, which I charred lightly but evenly. The wood must be burned in streaks with the grain to preserve the natural effect. It is important to make the wood as black in one spot as in another, excepting

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of course if any parts are always in the rays of the light, they can be made a few shades darker to good advantage, so that when they are finished they will harmonize better with parts that are in shadow more or less.

Following the charring operation, I scraped the surfaces lightly with a floor scraper, being careful to work with the grain of the wood. Then I went all over the surfaces with steel wool, cleaning up thoroughly afterward by dusting. I applied a filler, which in this particular case I made of the following: ¼-lb. Sherwin-Williams burnt umber, 3-qt. boiled linseed oil, 1 qt. pure turpentine and 1-lb. corn starch. This must be stirred well after mixing and also while in use because the corn starch will settle to the bottom very easily. The reason I mentioned Sherwin-Williams burnt umber is because all brands of colors are not exactly the same shade.

The filler must be wiped off, soon after it is applied, with cotton waste, cotton cloth or cheese cloth; never wipe with burlap or anything that will leave lint on the wood, as lint is almost impossible to clean off. When the surface had been thoroughly cleaned and was dry I applied a coat of Johnson's "Under-Lac." After 12 hours I rubbed this down with No. 00 steel wool. Then I followed with three coats of high-grade floor varnish. Some interior varnishes are easily marred and will show white on desk tops and around base boards where the surface is scratched or struck repeatedly by the brooms and mops that are used when cleaning. I rubbed the first and second coats of varnish with pumice stone and oil but left the last coat a gloss finish.

On the panel strips, I used one coat of "O'Brien's" No. 24 dark mahogany stain. In 12 hours, I put on a coat of Johnson's "Under-Lac." This stood 2 hours and I put on a coat of "Pyramid" floor finishing varnish. After 12 hours I rubbed the first varnish coat with pumice stone and oil. The other two coats were put on, the second being followed by rubbing and the third coat being polished with rotten stone and oil. This finishing process made the woodwork look like new and the varnished surfaces were smooth, hard and durable. The color scheme made the fixtures and paneling unusually attractive.

The walls, ceilings and insides of doors of lumber-drying kilns require a protective coating of paint that will stand temperatures up to 200 degrees F., and humidities up to 100 per cent.; also the circulation of moist hot air laden with the chemical "throw-off" of different kinds of woods.

To prevent woods from "eating-up" or absorbing so much varnish, or under-coat paint for enamels, it is customary to apply one and sometimes two thin coats of shellac. One coat is usually sufficient excepting in cases where the wood is very porous or very oily.

A mixture of three bushels of sawdust and 10 pounds of carbonate of soda serves as an excellent extinguisher of varnish, gasoline and other similar fires.

Finishing Gum and Birch

A practical finisher gives some suggestions on methods and materials to use in finishing gum and birch, so as to bring out the figure and beauty of the wood to best advantage

By J. D. Austin

THE popularity of gum wood for interior woodwork in residences, as well as in offices and public buildings, is steadily increasing, and it is necessary for the interior finisher to know how to stain this wood so as to get the best results. Some of us finishers can remember the time when gum was purposely avoided, principally because we did not know how to finish it without making it look muddy. There are still many finishers who do not know how to finish gum so as to bring out all of its rich figure in a clear, transparent finish. The great trouble lies in using stains that are too dark for this kind of wood. Gum is a soft, absorbing wood, and it requires a stain having considerable body and little color to produce the best results, that is when an oil stain is used. Oil stain is best for making a walnut finish on gum; water stain is best for producing a mahogany finish.

A splendid walnut stain can be made from a good grade of furniture varnish and asphaltum varnish, using sufficient of the latter to color the former, and thinning with pure turpentine. Probably it would be misleading to give the proportions in which to use these two varnishes in a general way, because of the vast difference between makes of asphaltum varnish. If too much color is added to the furniture varnish the mixture may be reduced to the correct shade of color by thinning with turpentine; but this cuts the body from the stain, which is something to be avoided. A very good way to prepare the stain is to first thin the varnish by mixing 3 pints of varnish and 1 pint of turpentine, then adding sufficient asphaltum varnish to give the desired depth of color. This will make a clear, transparent stain that will reveal the true figure of the wood. It dries well and has sufficient body to seal the air cells of the wood and prevent absorption of succeeding coats, thus enabling them to stand out well.

When the stain is hard it should be rubbed with steel wool to a fine, smooth surface. If this is done in the right way, a surface of glass-like hardness and smoothness can be produced. This rubbing is important, because the amount of labor, as well as the appearance of succeeding coats, depends to a considerable extent on the condition of the surface at this time. With the foundation right there is every prospect of the succeeding coats being right. With the foundation wrong there is little hope of the rest being what it ought to be.

This same walnut stain gives a beautiful walnut effect on birch. But birch requires a second coat after the first coat has become thoroughly hard, because the stain will not penetrate the hard fibers; it leaves them with a faded appearance after the first

Certainly, one has no conception of the vast number of products of wood and metal construction on which finishing coats are applied until investigating thoroughly. With some idea of the magnitude of the field to be covered, we were, nevertheless, surprised to learn of the diversified list of products manufactured as specified on the questionnaire reply postals.

Following, we attempt to list the numerous products in condensed form:

Automobiles
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Locomotives
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Metal Doors
Metal Caskets
Medicine Cabinets
Musical Instruments
Mantels
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Piano Benches
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coat. For the second coat the stain should be made very thin with turpentine. The pores of the wood having been sealed by the first coat, the second coat does not penetrate at any point, but stays entirely on the surface, giving the hard fibers the correct shade. The first coat of stain should be rubbed to a fine surface with steel wool, and the second coat rubbed lightly.

After the stain is dry it may be bodied up with either shellac or varnish, or both. If both shellac and varnish are used the shellac coat should be a very thin one, and only pure shellac should be used.

Some Causes of An Unsatisfactory Lacquered Finish.

Since lacquer (both clear and colored) is an air-drying material, the air in the finishing room should be kept clear and dry. Most modern finishing rooms are equipped with temperature regulators so that it is possible to keep the room in good order.

Through July and August, and during the damp spring days, lacquer is more likely to blush or turn spotted and white.

Direct drafts from windows should be avoided in this kind of weather because, no matter how much heat there is in the finishing room at this time, blushing will occur from drafts of outside air. The water separator on or near the spray machine should be kept clear from water at all times. If moisture gets into the spray, colored lacquer will spot after blushing, and will leave a dark place after it is finished; this can only be remedied by doing it over again.

When the effects of bad weather conditions can not be entirely nullified, the only cure for blushing is to use retarder. This is a liquid to mix with lacquer to keep the lacquer from drying too fast. A little should be added to lacquer at the least sign of dampness or high-humidity conditions. This retarder is used in proportions ranging from small percentages to as much as one to three of lacquer. However, this is mostly up to the user, who must govern his mixture according to the conditions of the air.

Some colored lacquers will take more retarder than others. Be careful to not use too much retarder, as the top will seem dry, but under the surface it will take a long time to dry.

Oil in the air line should be avoided as it will blow out over the work, causing black spots. This can be overcome by keeping the air filter clean and not feeding the compressor too much oil. —J. K. Cooper.

Decalcomania or transfer varnish is used to hold the decalcomania firmly to the surface. The usual procedure is to coat the design with the varnish and allow it to lay a few minutes until tacky; then apply it to the surface. The paper is removed by wetting it with water. Then the decalcomania may be baked on at 180-deg. F. for one hour or air-dried for three or four hours. One or more coats of high-grade clear varnish are applied over the decalcomania to protect and preserve it.

Facts About Wood Lacquers

An experienced chemist, whose work is with finishes and finishing room problems, gives some interesting facts about the development, characteristics and methods of using genuine wood lacquers

By Walter K. Schmidt

LACQUERS have been in use for a good many years. They were primarily introduced in the metal industry by the Celluloid-Zapon Co. of New York. Back in the '80's a chemist discovered the use of gun cotton pyroxylin as a coating, which was immediately adopted to protect metal, and thus the word "lacquer" as we know it was applied to a material generally used on metals.

The woodworking industry, when lacquers were referred to, had in mind the Chinese and Japanese finishes which usually were of a brown color and decorated with gold and silver bronzes. When one mentioned a lacquer finish, the Japanese finish was immediately thought of; for a time it became the only finish applied to wood. The process generally consisted of coloring shellac with spirit soluble colors, applying several coats, and then rubbing to a polish, without, however, employing the continental method known as "French polishing."

During the early part of the World war, there was some difficulty in obtaining certain raw materials necessary for making wood finishing materials. There came an era where speed was required. In this same era, the finishes changed greatly. The demand was for a protecting coat, that would give the beauties of the wood an opportunity to show themselves, and at the same time be thoroughly protected. The entire scheme of things was to deliver as good service in the finishing coat, but to do it in a less time and with less material. The condition of things was recognized by the makers of pyroxylin. They also had in mind the number of times they had been approached by various foreman finishers for an article that would be absolutely water-white, and which would serve to protect finishes of a delicate color.

Back in 1893, at the World's Fair in St. Louis, was an exhibit of furniture made in gray maple. At that time everybody wondered how it was finished; we couldn't seem to do it. In the efforts to use a light colored wax, the writer recalls that one of the largest factories in the country tried to protect this delicate color with a solution of parafin wax. At that time wood lacquer was not born; it required a war to start something, and thus the new product wood lacquer was introduced.

About the time that Italian walnut was at its height in popularity the company, above referred to, introduced a material as "wood lacquer" and gave it the trade name of "Zaponite." The word is taken from the German word "Zaponieren," which means giving a product a protective coat. It is presumed that Italian Walnut finish is well enough known so that it may be

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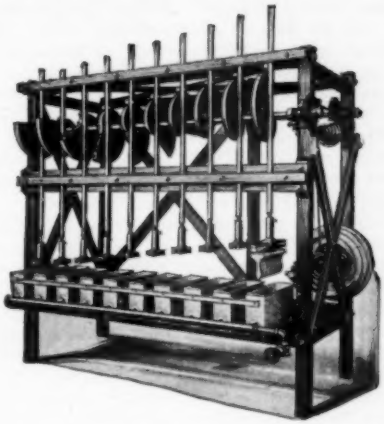

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referred to as typifying a series of finishes. These finishes were scant, but they deliver a service absolutely satisfactory to the user.

An open-pore finish with no filler presents a greater surface than a closed-pore or filled surface. In fumed oak, like Italian walnut, in order to give it proper protection, a material is required that not only covers the outer strata but which follows every crevice, such as is presented in the pores of the wood. It must be a material that does not bridge the pores and leave air cells, which are gradually broken into, thus exposing the surface to moisture. Spill water on a piece of open-pore furniture and, unless these crevices are all protected, it is absolutely impossible to wipe off all the water, and avoid absorption. One can imagine the injury that may rise, especially if the top is veneered.

In the advent of wood lacquer this outstanding feature was immediately recognized, and on such finishes it was generally used. The satisfaction created put a demand upon manufacturers of wood lacquers for a material that would go farther and give what is generally known as a built-up finish. So well had the pioneer article served its purpose that this demand came honestly from those who had thoroughly familiarized themselves with the usage and qualities of this new product.

To produce a material that carries with it the outstanding qualities of a wood lacquer, and add to it the qualities of other finishing materials, is a problem that could only be handled by concerns who are thoroughly conversant with the manufacture of pyroxylin, and the behavior of the many types under certain conditions. This very point has worked to the disadvantage of wood lacquer itself. As soon as the first article was recognized for its peculiar qualities, there appeared on the market under all sorts of names, materials sold as wood lacquers which have no right to exist under this name. Several years were required to produce a material that would continue the qualities of the first offering, and at the same time deliver a body that would give what the finishing world wanted, namely, a built-up surface.

The first wood lacquer gave the protection. It was waterproof and heatproof; it would not print, would not check or craze; it was tougher than anything ever made before; it could not be applied with a brush, but modern equipmenut no longer demands this method of application. Wood lacquer fitted in to the modern plant where all materials are applied with a spray. Now if to all these qualifications was to be added the feature of a built-up finish, it became necessary to overcome one deficiency—the lack of bridging in the original wood lacquer. Experiments carried on at first gave the body so that two or three coats would build a standard finish, but there was a difficulty that still had to be met. The single shortcoming was that of bridging over a filler.

The original solvents of the first wood lacquers were found to attack the filler, and, during the experimental stages of wood lacquer, it was nearly impossible to produce a true surface sufficiently heavy to make a built-up coat. During experiments that followed it became desirable to ascertain the constituents of many wood

fillers. It was found that the greatest difficulty lurked in the fact that certain wood fillers contained lakes as coloring material. Thus was brought about the general elimination of lakes in the better grades of wood filler.

So in the line of progress it was found that a surfacing coat built along the lines of wood lacquer used as a sealer (the same as shellac is used under varnish) was desirable—desirable for more than one point. The material can be thinned and sprayed, and followed with the wood lacquer coats. Another outstanding feature of wood lacquer is that it dries dust free.

The entire lacquer situation has shown a wonderful progress, and that a material of its peculiar qualifications is in demand, is evinced by the fact that the number of concerns offering it has been multiplied by ten since the event of its introduction. It is assumed that every user of finishing materials is familiar with artificial bait for fishing and that many of them use it. Have you ever given a thought to the fact that artificial minnows are universally protected with a pyroxylin finishing material? This is mentioned merely to bring home the fact that this little bait is subjected to the water, the sun, and the elements. The fisherman rarely gives consideration to the finish on his paraphernalia. The bait is made to go into the water; we take it out, we never wipe it off, we let it lie in a boat day after day and season after season, yet when we get out the fish box again we find the artificial bait in perfect condition. The material used is lacquer enamel.

Wood lacquer, of pyroxylin base, is a versatile finish. It is brought to our attention as enamel in an indefinite range of colors, doing everything that the ordinary enamel can do, and more, since it resists not only moisture but heat. Again we find it in toyland. In the nursery all toys are Humpty-Dumpties and Jacks and Jills, but all the falls and all the crown breakers in the kingdom of toyland can be let loose upon the pyroxylin finished plaything, and it will come through the scrimmage without a scratch.

A finish that satisfies the instinctive demand for pretty things is absolutely assured. Any color effect, or a clear, transparent finish is easily achieved. We also find this sort of finish employed in producing the many polychrome finishes, because it is one of the best protectors of the various shades of bronzes.

It should be known that a wood lacquer (referring of course, to a genuine wood lacquer and not to the dozen or more imitations disguised under the caption of "wood lacquer") comes to a permanent state when the solvents are completely evaporated. This is the oustanding feature of wood lacquer; it differs from many of the preceding wood finishes in that they dry by oxidation. Wood lacquer becomes a permanent self-contained coating immediately, whereas many others, depending upon oxidation, become permanent only when oxidation is completed. One might say this is drawing the line very closely, nevertheless it is a fact.

To get a good lacquer finish the wood must be properly prepared. Every wood finisher knows what this means—an absolutely smooth surface. If filled, the filler should be worked well into the

pores and leveled off. It is better to use a short oil filler. Avoid fillers containing lakes, or those that are low in pigment; clean them off thoroughly and see that you have a level surface. This is desirable from the fact that good lacquers are very transparent and lay close to the surface.

In staining the wood, use water stain. Oil stains fade and bleed through the lacquer to a greater extent than through varnish. Creosote stains should never be used. The undercoats supplied or recommended by manufacturers of good wood lacquer are desirable. Following these suggestions, there is no reason why any good wood lacquer will not furnish a high-grade finish.

How can a finisher distinguish good from poor quality wood lacquer? A good lacquer will spray well and it should spray without trapping air. An experienced operator can employ it successfully with air pressure up to 70 pounds without injury to the surface he is producing. It should have good adhesion, and not strip from the wood after 24 hours' drying. It should contain no camphor or other volatile solids which gradually leave film. It should show no deterioration in toughness on aging, should be light in color, and should not bridge in the corners.

The question of competitive price must be considered only in a general way and taken into account on production basis. A good lacquer may be purchased in quantity at the price of a good varnish—around $2.50 per gallon. Lacquer has about 30 percent less covering capacity, making the material cost approximately 30 percent more than a good varnish. But, on the other hand, a built-up finish can be obtained in six to seven days, with lacquer air drying, as compared with double that time for varnish. When lacquer enamels are used, two days' drying time is sufficient. Consequently its use cuts down space in the finishing room; the inventory figures are lower; rush orders are handled more quickly; forced drying is not necessary.

A few general pointers to consider when using wood lacquer are as follows:

Hold the spray about 7 inches from the work and always see that it leaves a full wet coat; lacquer can not be brushed successfully. Judgment must be used as to the air pressure, avoiding a pressure that will cause "dusting". Use good judgment. Consider the size of the nozzle of your air gun and learn the ratio of pressure necessary. There is nothing difficult about applying lacquer; there is no mystery.

If a drying room is used, no humidity control is necessary. The work, however, should not be placed in a drying room until it is dry to the touch; otherwise the solvent will form pin-holes or bubbles.

Water and oil must be eliminated from compressed air. Observe the same precautions that you would use for any other finish, but remember that wood lacquer works quicker. Unreasonable speed should not be attempted. Learn how soon you can successfully rub before taking on the whole job. Just a bit of experimenting will bring out the finer points. The finisher who is looking for results and who will follow the directions and recommendations given him by the manufacturer, will in this case profit thereby.

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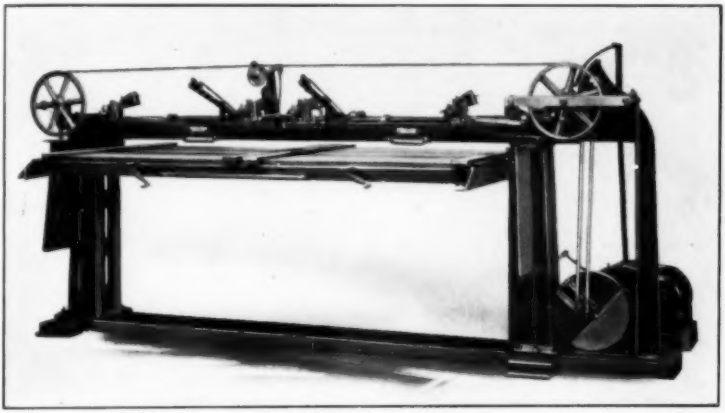

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